WHAT IS CLAIMED IS:

1. A method for modifying a refractive index of an optical wave-guide device having a core section and a clad section, said method comprising the steps of:

irradiating ultra short pulse laser rays having a pulse width not more than 30 pico-seconds to at least one of the core section and the clad section

2. The method as defined in claim 1, wherein the ultra short pulse laser rays have photon energy lower than half of band-gap energy of a material of the clad section.

3. The method as defined in claim 1, wherein the ultra short pulse laser rays are irradiated to the core section including a periphery thereof, only to the core section or to a part of the core section, thereby changing the refractive index of the core section or the part of the core section without changing the refractive index of the clad section.

4. The method as defined in claim 1, wherein the ultra short pulse laser rays are focused to the core section

including a periphery thereof, thereby changing the refractive index of the periphery of the core section together with the refractive index of the core section.

5. The method as defined in claim 1, wherein the ultra short pulse laser rays are irradiated, while scanned along the core section at least one time, to the core section of the optical wave-guide to modify the refractive index thereof.

6. The method as defined in claim 1, wherein the core section includes a plurality of stacked layers or a three-dimensional structure, and the ultra short pulse laser rays are irradiated to the bottom part of the core section to modify the refractive index thereof without changing the refractive index of the top part of the core section.

7. The method as defined in claim 1, wherein the refractive index of the irradiated part is elevated by increasing a density of the irradiated part.

8. The method as defined in claim 1, wherein the refractive index of the irradiated part is reduced by decreasing a density of the irradiated part or producing holes therein.

9. The method as defined in claim 1, wherein the optical wave-guide device is thermally treated after the modification.

10. The method as defined in claim 1, wherein the laser rays having a power density of saturating the change of the refractive index of the core section are irradiated.

11. The method as defined in claim 1, wherein the laser rays are irradiated to the core section for heating the core section as well as for modifying the refractive index of the core section, thereby unnecessitating thermal treatment.

12. The method as defined in claim 1, wherein when a surface of the optical wave-guide device is uneven, the laser rays are irradiated after liquid or gelled material having a refractive index substantial same as that of the clad section is applied to the surface, and a transparent material through which the laser rays permeate is applied thereon to flatten the surface.

13. The method as defined in claim 1, wherein the shape of the core section transmitting the rays is changed

to have a taper.

14. The method as defined in claim 1, wherein the core section includes a grating for diffracting rays transmitting in the core section to any direction.

15. The method as defined in claim 1, wherein the core section for guiding the rays and doped with GeO_2 in the glass optical wave-guide device includes a planar slub wave-guide which is subjected to the refractive index modification.

16. The method as defined in claim 1, wherein the core section of at least one of the optical wave-guide and a section of coupling rays of a coupler is subjected to the refractive index modification.

17. The method as defined in claim 1, wherein the optical wave-guide device includes an array wave guide grating for dividing the multiplexed rays used for WDM optical telecommunication and binding the divided rays, and the refractive index is modified such that the ray having a specified wavelength is coupled to the optical wave-guide.

18. The method as defined in claim 1, wherein the optical wave-guide device includes a fiber grating for diffracting a ray having a specified wavelength and the refractive index of the grating is modified by the specified wavelength.

19. An apparatus for modifying a refractive index of an optical wave-guide device:

a stage section for holding and moving the optical wave-guide device in "x", "y" and "z" directions mounted in a chamber;

a lasing section for emitting laser rays having a pulse width not more than 30 pico-seconds used for modifying the refractive index of a core section mounted in the chamber; and

an optical system section for irradiating the laser rays lased in the lasing section on the core section of the optical wave-guide device in "x", "y" and "z" directions mounted in the chamber.

20. The apparatus as defined in claim 19, wherein the apparatus includes a function of irradiating ultra short pulse laser rays to the core section of the optical wave-guide device for modifying the refractive index while the rays are guided after an optical fiber is bonded

to an input and output surface of an optical wave-guide device for modifying the refractive index, and a function of feed-backing outputs from the optical wave-guide device to irradiation conditions of the laser rays for obtaining the change of the refractive index of the target core section.

21. The apparatus as defined in claim 19, wherein the core section and the clad section of the optical wave-guide device are made of amorphous or a polymer molecule, and the refractive index of the core section of the device was modified.

22. The apparatus as defined in claim 19, wherein the optical wave-guide device is formed in a glass thin film having a thickness of 100 μm or less overlying a silicon substrate, and the refractive index of the core section of the optical wave-guide is modified.

23. The apparatus as defined in claim 19, wherein the optical wave-guide device includes a plurality of optical wave-guides having an interval of 30 μm or less, and the core sections of the plurality of the optical wave-guides are individually modified.

24. The apparatus as defined in claim 19, wherein the core section for guiding the rays in the optical wave-guide device containing glass-based material includes no GeO_2.

25. The apparatus as defined in claim 19, wherein a surface shape of the optical wave-guide irradiated with the laser rays is convex to act as a lens to focus the irradiated rays to the core section of the laser wave-guide.